Cook Inlet Basin NAWQA News

National Water-Quality Assessment Program

Status Report, Winter/Spring 2000

What is NAWQA?

The Cook Inlet Basin in south-central Alaska (see maps) is one of about 60 National Water-Quality Assessment (NAWQA) study units designed to assess the status and trends of the Nation's water quality. This program integrates the monitoring of surface- and ground-water chemistry with the study of aquatic ecosystems. The Cook Inlet Basin study began in 1997. This newsletter presents the findings of the study from 1997 to September 1999.

Environmental Setting

The Cook Inlet Basin has a variable climate largely owing to a range in altitude from sea level to 20,320 feet. Annual precipitation ranges from about 20 to 240 inches, and average air temperature ranges from 22 to 42 degrees Fahrenheit. Natural factors that influence water quality of the freshwaters of the Cook Inlet basin are geology, soils, land cover, and the presence of glaciers. Human factors that influence water quality are residential development, recreational use, timber harvesting, mining, and petroleum development.

Geologically, the area is characterized by many types of consolidated rocks in the mountains and unconsolidated sediments in the lowlands. Glaciation has dramatically altered the landscape, and presently, glaciers are extensive on the eastern, western, and northern boundaries of the study unit. Discharge from streams and rivers in the Cook Inlet Basin varies depending on the presence of glaciers in a particular watershed. The graph below the table on the next page shows that streams with melting glaciers have more sustained runoff than nonglacial streams.

> The average annual surface-water discharge into Cook Inlet is estimated to be 116,000 cubic feet per second, or 75 billion gallons per day. The Susitna River accounts for 47 percent of the total.

Location of Cook Inlet Basin and study sites (see table on next page for site names).

USGS science for a changing world

Cook Inlet Basin, Alaska
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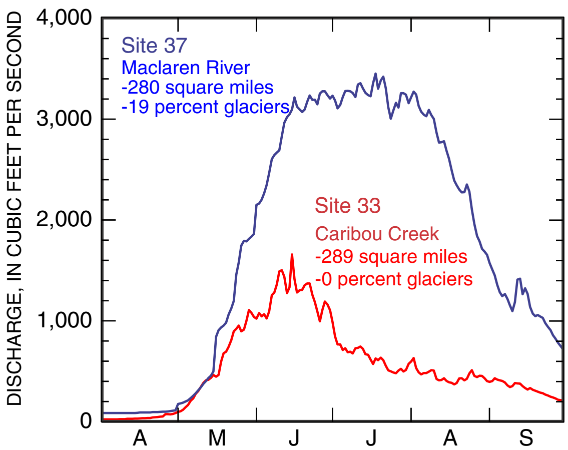
Winter/Spring 2000
ak.water.usgs.gov/Projects/Nawqa

U.S. Department of the Interior
U.S. Geological Survey

Sites Shown on Maps

Site	Name
3	Bradley River near Homer
6	Anchor River at Anchor Point
7	Ninilchik River at Ninilchik
8	Kasilof River near Kasilof
16	Kenai River at Soldotna
18	Resurrection Creek near Hope
21	Glacier Creek at Girdwood
23	South Fork Campbell Creek near Anchorage
24	North Fork Campbell Creek near Anchorage
25	Campbell Creek near Spenard
26	Chester Creek at Anchorage
27	Chester Creek at Arctic Boulevard at Anchorage
29	Ship Creek below Power Plant at Elmendorf Air Force Base
30	Eagle River at Eagle River
32	Knik River near Palmer
33	Caribou Creek near Sutton
34	Matanuska River at Palmer
35	Little Susitna River near Palmer
36	Susitna River near Denali
37	Maclaren River near Paxson
38	Susitna River near Cantwell
39	Susitna River at Gold Creek
40	Chulitna River near Talkeetna
41	Talkeetna River near Talkeetna
44	Deshka River near Willow
45	Skwentna River near Skwentna
46	Susitna River at Susitna Station
48	Chuitna River near Tyonek
49	Chakachatna River near Tyonek
50	Moose Creek near Palmer
51	Kamishak River near Kamishak
52	Johnson River above Lateral Glacier near Tuxedni Bay
53	Kenai River below Russian River near Cooper Landing
54	Kenai River at Jim's Landing near Cooper Landing
55	Kenai River below Skilak Lake Outlet near Sterling
56	Swanson River near Kenai
57	Colorado Creek near Colorado
58	Costello Creek near Colorado
59	Rabbit Creek at Hillside Dr. near Anchorage
60	Rabbit Creek at East 140th Ave. near Anchorage
61	Rabbit Creek at Porcupine Trail near Anchorage
62	Little Rabbit Creek at Nickleen St. near Anchorage
63	Little Rabbit Creek at Goldenview Dr. near Anchorage
64	Campbell Creek at New Seward Highway near Anchorage
65	Campbell Creek at C St near Anchorage
66	South Branch of South Fork Chester Creek at Tank Trail near Anchorage
67	South Branch of South Fork Chester Creek at Boniface Pkwy near Anchorage
68	Ship Creek at Glenn Highway near Anchorage
69	Little Rabbit Creek near Anchorage



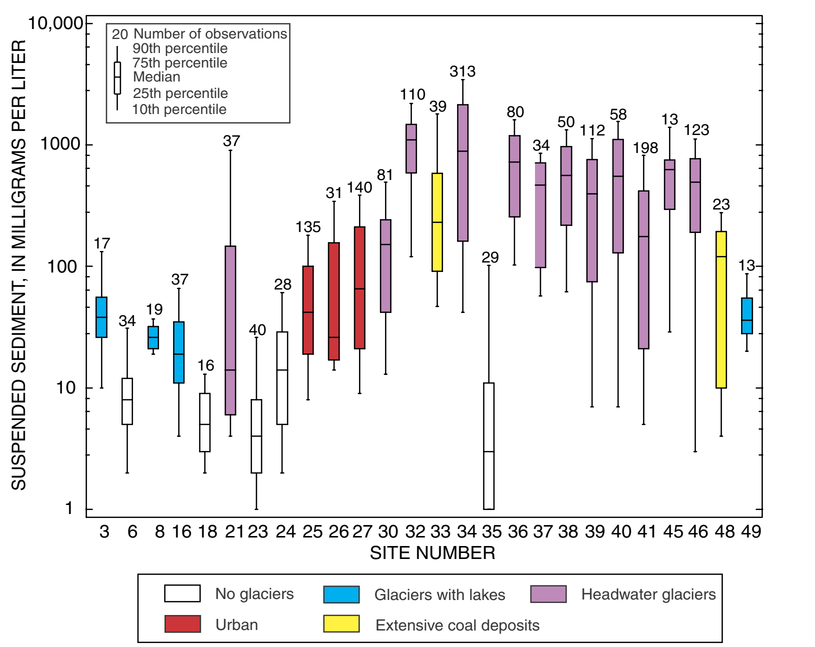
Comparison of spring through autumn discharge between a glacial and non-glacial stream.

Ground Water. Ground-water quality, although generally good, may be degraded locally from naturally occurring trace elements such as arsenic or from human activities. Concentrations of arsenic that exceeded drinking-water standards were observed in ground water on the Kenai Peninsula. Human activities that have degraded ground-water quality include leaks or spills of petroleum products, and waste disposal. Areas of the Anchorage Hillside have shallow ground water containing nitrate concentrations that exceed drinking-water standards.

Glaciers cover about 11 percent of the Cook Inlet Basin. Glacier-fed streams have different physical characteristics from streams that do not have glacier contributions.

Water-Quality Data Through 1997

Surface Water. Few stream sites in the Cook Inlet Basin have long-term records of water quality. Generally, both surface and ground water in the Cook Inlet Basin is of very good quality and is suitable for domestic and public uses. Streams typically are cool, well oxygenated, have near neutral pH, and low dissolved-solids concentrations. Although the State of Alaska does not have a water-quality standard for suspended sediment, water that has high suspended-sediment concentrations may require treatment for use as drinking water. Suspended-sediment concentrations in the Cook Inlet Basin are most strongly affected by the presence of glaciers (see graph to the right); however, other local influences may also elevate concentrations. Fecal coliform bacteria, which are used as indicators of fecal contamination, have been measured above water-quality standards for drinking water and for water-contact recreation in some Anchorage streams. The Alaska Department of Environmental Conservation lists parts of several streams and lakes in Anchorage as impaired by high fecal coliform bacteria concentrations.



Suspended-sediment concentrations in water from selected sites in the Cook Inlet Basin.

USGS hydrologist collecting water sample, South Fork Campbell Creek.

Water-Quality Sampling During 1998

During 1998, selected organic compounds and trace elements in streambed sediments and fish (slimy sculpin) tissue were investigated at more than a dozen sites in the Cook Inlet Basin. About half of the sites were along the road system, whereas the rest were in more remote areas including in three national parks (see map on first page).

Organic Compounds: Organochlorine pesticides and polychlorinated biphenyls (PCBs) were detected in just three samples of slimy sculpin from a total of 12 samples analyzed.

- Samples of fish from South Fork Campbell Creek near Anchorage contained concentrations of p,p'-DDE (a degradation product of the insecticide DDT) and p,p'-DDT.
- Hexachlorobenzene concentrations were measured in slimy sculpin from the Talkeetna River.
- Total PCBs were detected in a slimy sculpin from Chester Creek in Anchorage.
- Streambed sediments from six sites were analyzed for 32 organochlorine pesticides and PCBs and only a single compound—hexachlorobenzene at the Talkeetna River—was detected at reportable concentrations.

Semivolatile organic compounds in bed sediments were rarely measured in concentrations exceeding minimum reporting levels at 15 sites sampled in the Cook Inlet Basin in samples of sediment.

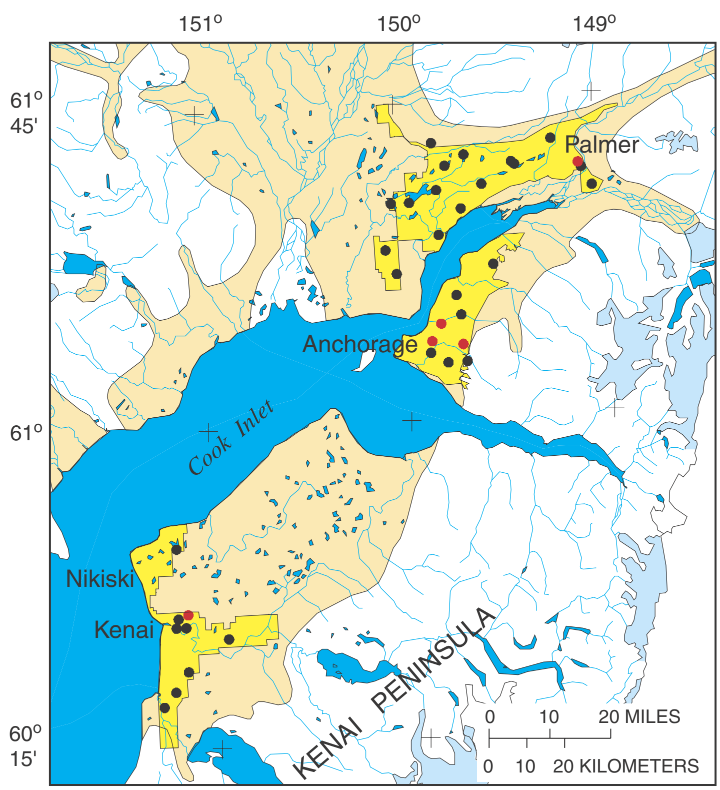
- No semivolatile organic compounds were detected at five sites.
- Three or fewer semivolatile organic compounds with concentrations greater than the minimum reporting level were detected at eight additional sites.
- Chester Creek in Anchorage had the largest number of semivolatile organic compounds detected (23). Concentrations also tended to be highest at Chester Creek, which was the only site sampled whose drainage basin was largely urbanized.

Trace Elements: Four trace elements—arsenic, chromium, copper, and nickel—appear to be at naturally high concentrations in streambeds throughout the Cook Inlet Basin. The highest concentrations of arsenic, chromium, and nickel were from two sites in Denali National Park and Preserve. Cadmium, lead, and zinc concentrations were elevated in streambed sediments from Chester Creek. Selenium was elevated at the Deshka River, a remote, undeveloped basin draining vast areas of wetlands. Selenium concentrations in slimy sculpin at more than half the sites were at levels that may cause adverse effects in some fish species.

Water-Quality Sampling During 1999

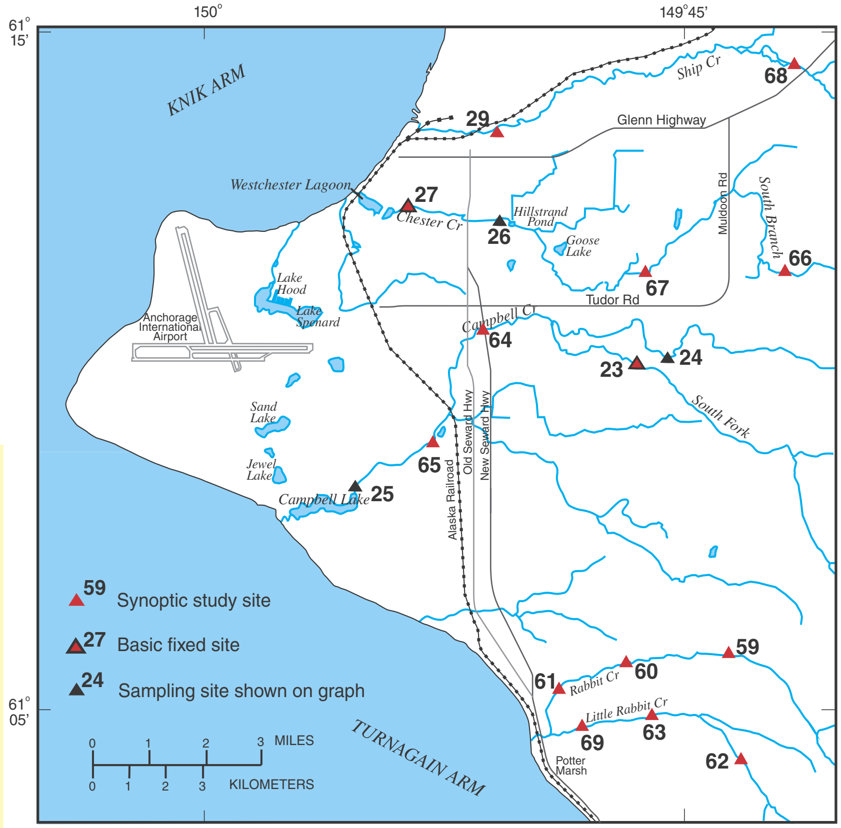
During the 1999 water year (ending September 30, 1999), intensive water-quality sampling was done at six stream sites in the Cook Inlet Basin (termed "basic fixed sites"): Ninilchik River at Ninilchik (site 7), Kenai River below Skilak Lake Outlet near Sterling (site 55), Kenai River at Soldotna (site 16), South Fork Campbell Creek near Anchorage (site 23), Chester Creek at Arctic Blvd. near Anchorage (site 27), and Deshka River near Willow (site 44) (see site maps). These basic fixed sites were selected to address water-quality issues related to residential development, recreational use, and timber harvesting. Samples were collected for analysis of major anions and cations, nutrients, organic carbon, and suspended sediment. Samples from Chester Creek and South Fork Campbell Creek were also collected for analysis of pesticides and volatile organic compounds. Samples were collected at a fixed frequency with additional samples collected during snowmelt and rainfall peak flows. Ecological characteristics of the six basic fixed sites were described by making measurements of the stream and riparian habitats at reaches as long as 3,000 feet. Within those reaches, samples of benthic algae, invertebrate, and resident fish were collected.

The quality of ground water in the populated areas of the Cook Inlet Basin was determined through a random sampling of 30 domestic wells and 5 public-supply wells (see map below). Ground-water samples were analyzed for major anions and cations, nutrients, organic carbon, pesticides, volatile organic compounds, radon, and radium. Additionally, the recharge age of the sampled water is being determined, as well as the types of land uses surrounding each well.



Ground-water sampling sites, 1999.

During 1999, preliminary sampling was conducted at 14 sites in Anchorage (red triangles on map to the right) that define a gradient of residential development. At those sites, nutrients, major dissolved ions, suspended sediments, and organic carbon concentrations were measured in water samples; trace element concentrations were measured in streambed sediments; chlorophyll concentrations were measured from samples of the benthic algae community; and benthic macroinvertebrate samples were collected. A detailed synoptic study on the effects of residential development is planned for 2000 at these 14 sites.



Location of sampling sites in the Anchorage area.

Publications

The Cook Inlet NAWQA has recently published the following reports: (1) *Water-Quality Assessment of the Cook Inlet Basin, Alaska--Environmental Setting:* U.S. Geological Survey Water-Resources Investigations Report 99-4025; (2) *Water-Quality Assessment of the Cook Inlet Basin, Alaska--Summary of Data Through 1997:* U.S. Geological Survey Water-Resources Investigations Report 99-4116; and (3) *Selected Organic Compounds and Trace Elements in Streambed Sediments and Fish Tissues, Cook Inlet Basin, Alaska:* U.S. Geological Survey Water-Resources Investigations Report 00-4004.

For copies, please contact project chief (address below).

On-line versions (PDFs) of these reports can be downloaded from: http://ak.water.usgs.gov/Projects/Nawqa/nawqa_pubs.htm

This newsletter was prepared by the Cook Inlet Basin study team. The purpose of the newsletter is to keep members of the Cook Inlet NAWQA liaison committee informed of our activities. The newsletter represents the views of the COOK NAWQA team and is intended for information purposes only. It is not intended for redistribution or publication, and should not be cited. If you would like your name removed from or a name added to the mailing list for this newsletter, or if you have any comments regarding this newsletter or our workplans, please contact project chief Steve Frenzel at (907)786-7107, or write to COOK NAWQA, U.S. Geological Survey, 4230 University Drive, Suite 201, Anchorage, AK 99508-4664, or send email to sfrenzel@usgs.gov